British Columbia/Washington Marine Science Panel: Ten Years Later

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Background – Andrea Copping

The inland marine waters of British Columbia and Washington comprise a single ecosystem with active movement of water, organisms, and contaminants throughout the range. Yet these waters straddle the international boundary and represent an area managed and exploited through different legal and economic systems. Declining resource populations, contamination of sediments and water, and competition for water and fisheries had raised concerns about the health and sustainability of the ecosystem.

In 1993 the Governor of the State of Washington and the Premier of British Columbia appointed the BC/WA Marine Science Panel to address the current status and project future trends of the marine waters and resources of the region. Figure 1 highlights the shared marine ecosystem, showing the inland marine waters of Puget Sound, the Straits of Juan de Fuca and Straits of Georgia.

Figure 1 – The Shared Marine Waters

The MSP issued a report in 1994 that identified loss of functional habitat, particularly nearshore habitat, as being the greatest threat to the health and integrity of the ecosystem. The panel used the concept of ecosystem recovery time and avoidance of irreparable harm to identify invasive species, and loss of fish and wildlife, as additional major threats. The MSP recommended creation of marine protected areas as a means to address some of the problems. The report helped direct the development of agency workgroups and conservation activities to address habitat protection, species protection, and reduction of contaminants (BC/WA Marine Science Panel 1994).

Ten years later the MSP members came together to consider whether the 1994 report effected substantive change, to re-evaluate the state of the shared waters, to second-guess their original evaluation, and to consider the direction that regional marine conservation efforts might take in future.

Findings of the MSP report were covered briefly by Andrea Copping. The panel defined the threats to the shared marine waters in terms of risk, which was defined as the probability that a hazard will cause harm to the environment. The panel developed criteria to evaluate relative risk, the most significant of which was the concept of Recovery Time, defined as the time required for the environment to reduce/eliminate a contaminant or resource stress, and for harm to be eliminated. Four periods of Recovery Time were defined by the panel:

- short = 0-3 years;
- medium = 3-30 years;
- long = greater than 30 years; and
- irreversible = more than 100 years.

The key findings and recommendations are summarized in tables 1 and 2.

Table 1 – Finding of the Marine Science Panel – Status of Marine Populations, Habitats and Human Health Risks (BC/WA Marine Science Panel 1994).

Current and Projected Status of Components of the Shared Waters: Optimum Future Scenario

Component	Present Status WA	Present Status BC	Recovery Time	Status Change 1994 to 2014 WA	Status Change 1994 to 2014 BC
Aquatic Habitats					
Vegetated shores	Very Poor	Good	Irreversible	Unchanged	Unchanged
Unvegetated shores	Acceptable	Good	Irreversible	Unchanged	Unchanged
Rivers upstream	Poor	Acceptable-Good	Irreversible	Unchanged	Unchanged
Subtidal	Good	Good	Medium	Slightly Better	Slightly Better
Urban Sediments	Very Poor	Poor	Medium	Slightly Better	Slightly Better
Water Column	Very Good	Very Good	Short	Unchanged	Unchanged
Living Resources					
Salmonids	Very Poor	Acceptable-Good	Medium–Long	Slightly better	Slightly better
Marine Fish	Very Poor	Good	Medium–Long	Slightly better	Slightly better
Bottomfish in urban bays	Poor	Good	Medium	Slightly better	Slightly better
Commercial/ Recreational Invertebrates	Good	Good	Medium	Slightly better	Slightly better
Birds	Mixed	Mixed	Medium–Long	Slightly better	Slightly better
Marine Mammals	Mixed	Mixed	Medium–Long	Slightly better	Slightly better
Human Health					
Safety from direct contaminant & pathogen exposure	Very good	Very good	Short	Unchanged	Unchanged
Safety from contaminated seafood	Good	Good	Short-Medium	Slightly better	Slightly better
Safety from toxic algae	Good	Good	Irreversible	Slightly worse	Slightly worse

Table 2

Marine Science Panel recommendations

Actions	highest / lowest	Effective environmental management
Minimize estuarine wetland habitat loss		Strategic planning
Establish marine protected areas		Comprehensive program review
Protect marine animals and plants		Monitoring/research/ Management framework
Minimize large fresh water diversions		Increased public and scientific communication
Minimize introduction of exotic species		Freedom of scientific communication
Control toxic wastes		
Prevent large oil spills		

Fish and Fisheries - Ruston Sweeting

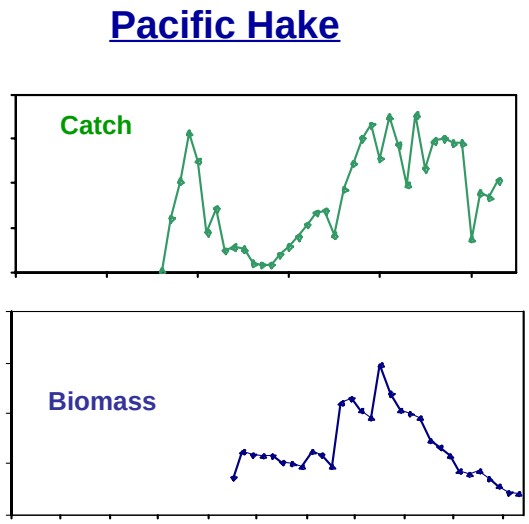
Ruston Sweeting summarized the status of fish and fisheries populations since 1994. The 1990s were generally poor for salmon marine survival from Oregon to Alaska, and many fisheries were closed. Other species, such as groundfish and dogfish, fared better but not

dramatically so. Marine survival of fish (and other wildlife) ultimately depends on ocean conditions.

Now it is generally accepted that ocean conditions undergo decadal-scale persistent states, termed regimes. Numerous proxy indicators, led by Length of Day index, suggested that we had a regime shift in early 1998, that manifested itself biologically in the 2000 productivity season, and has influenced fish populations in the region.

Rockfish are under strict conservation regulations along the entire west coast, from California to Alaska. Lingcod biomass appears to be increasing in the Strait of Georgia, after several years of conservation and non-retention. Hake biomass appears to be declining, although catches remain high, as shown in Figure 2.

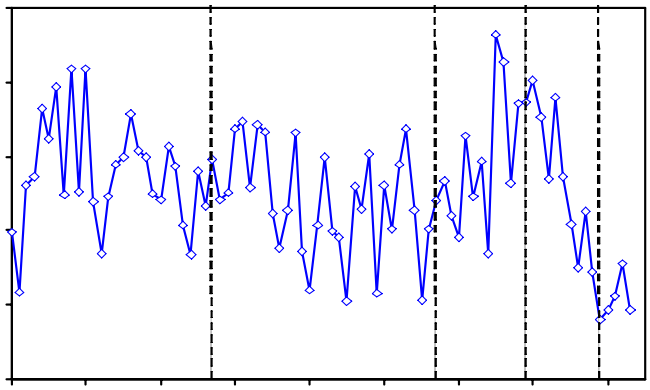
Figure 2



The regime shift of 1998 appears to have had impacts on the population trends of a number of species in 2000. Most responded positively (growth, survival, catch/escapement/biomass). Figure 3 shows the commercial catch of salmon in Canadian waters; the vertical lines indicate changes in regime. Puget Sound salmon stocks have generally responded better than Strait of Georgia stocks, but groundfish such as hake and herring appear to be doing better in the Strait of Georgia than in Puget Sound. Conservation 'fisheries' are in place for many groundfish species, many of which are long-lived and produce relatively low biomass. Climate, as well as fishing, affects fish abundance and future fisheries can benefit from appropriate and rapid management responses to regime shifts

Figure 3

Commercial catch (1000 mt) of Pink, Chum and Sockeye 1920-2002



Nearshore Habitat: Washington – Tom Mumford

Tom Mumford underscored the MSP's call for protection of nearshore habitat to be the highest priority in the shared waters. Loss of nearshore habitat causes significant, irreversible harm, is technically preventable, is extremely expensive or impossible to restore, and attempts to create new habitat to offset losses are not yet reliable. Mumford reiterated the findings of Levings and Thom (1994): the need for a common habitat classification system; common protocols for habitat assessment studies; a better understanding of habitat characteristics that may be key limiting factors to biological resources; common restoration goals for restoring populations that utilize both sides of the border; and better technology for landscape-scale habitat restoration. He reminded the audience that the MSP said a public process should be undertaken at the community level to determine the extent of losses that are acceptable to society, and that any further loss of nearshore estuarine habitat be prohibited in embayments that have already lost more than 30% of their historic habitat area, as the public process proceeds. He agreed with the recommendation that "no net loss" of nearshore estuarine habitat be permitted along shorelines that have not yet as severely degraded. Mumford also underscored the MSP recommendations that monitoring should be required of all habitat enhancement and restoration projects, and that estuarine habitat be the subject of additional research and monitoring efforts.

Mumford felt the MSP recommendations about nearshore habitat were correct, and unfortunately are still applicable ten years later. He listed some of the activities that have helped focus effort on habitat protection and restoration and listed some positive outcomes: The importance of "nearshore" is being recognized in Washington state and there is recognition that a large-scale framework is needed to guide restoration/ preservation; new guidelines in Washington (SMA/GMA) have the potential to significantly protect shorelines; and direct losses (conversion) of nearshore habitat appear to have slowed (Lynn 1998). We are also seeing new approaches to habitat, with a movement to process-based restoration, a watershed/ecosystem based approach, and

application of adaptive management and adaptive learning. In addition the importance of the social-sciences in addressing problems is being recognized.

There is bad news as well: more and more areas of the continent are recognizing the loss of nearshore habitat as a serious threat to ecosystems; losses in developed areas have slowed, but losses in relatively undeveloped and unregulated areas are increasing. New threats are emerging including the impact of single-family resident development and siting of aquaculture operations. There continues to be a serious lack of monitoring to reduce risk or increase knowledge, as well as misuse of knowledge about nearshore habitat functions. There continue to be serious indirect loss of function due to: cumulative effects of development and degradation of water quality on a local level, as well as localized loss of eelgrass (Figure 4). Warning signs such as the multi-year system degradation we have seen in Hood Canal (Washington) point towards the potential for large-scale loss.

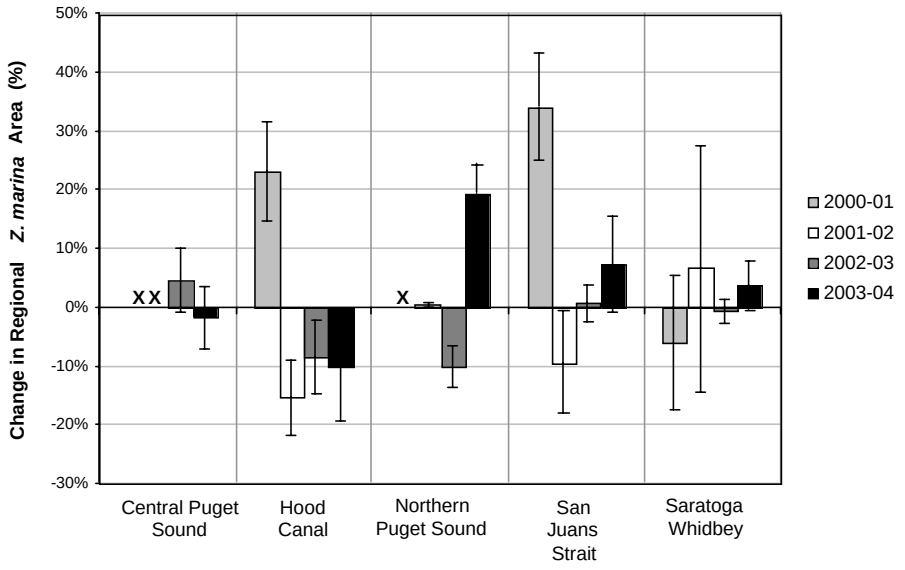


Figure 4. Change in area (ha) of eelgrass (*Z. marina*) in Puget Sound by regions during the period 2000-2004 (WA Dept of Natural Resources and PSAMP).

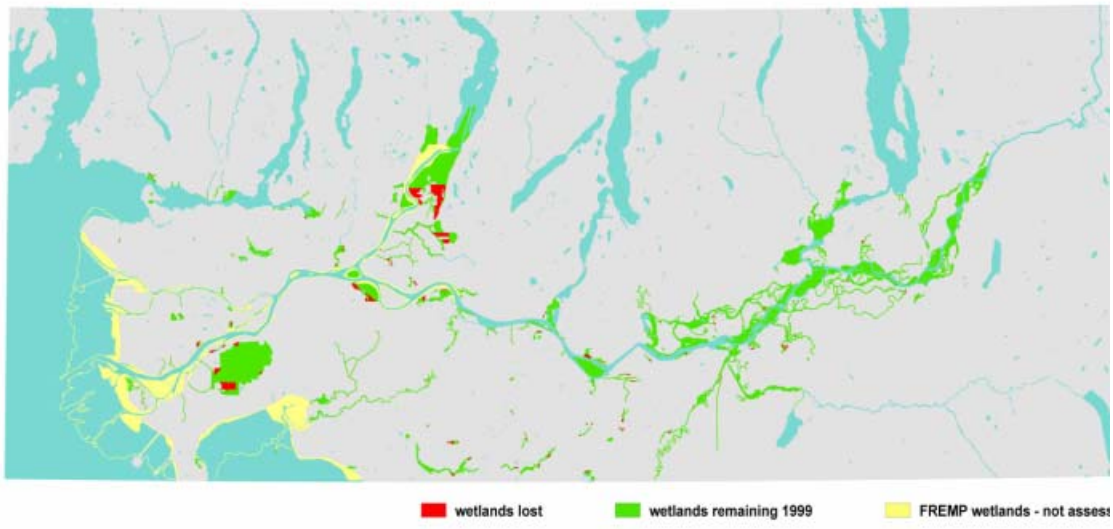
Mumford concluded that there are lots of good ideas and lots of action towards protecting and restoring habitats and local governments have become important players (Broadhurst XXX). However we are talking about "restoration", when we should be focusing more on cost-effective protection. The losses tend to be the result of multiple stressors, and the real problem is people- their numbers, behaviors, and values. He reiterated that a public process should be undertaken at the community level to determine the extent of losses

that are acceptable to society, and preventing destruction of nearshore estuarine habitat should be accorded the highest priority.

Nearshore Habitat British Columbia – John Ryder

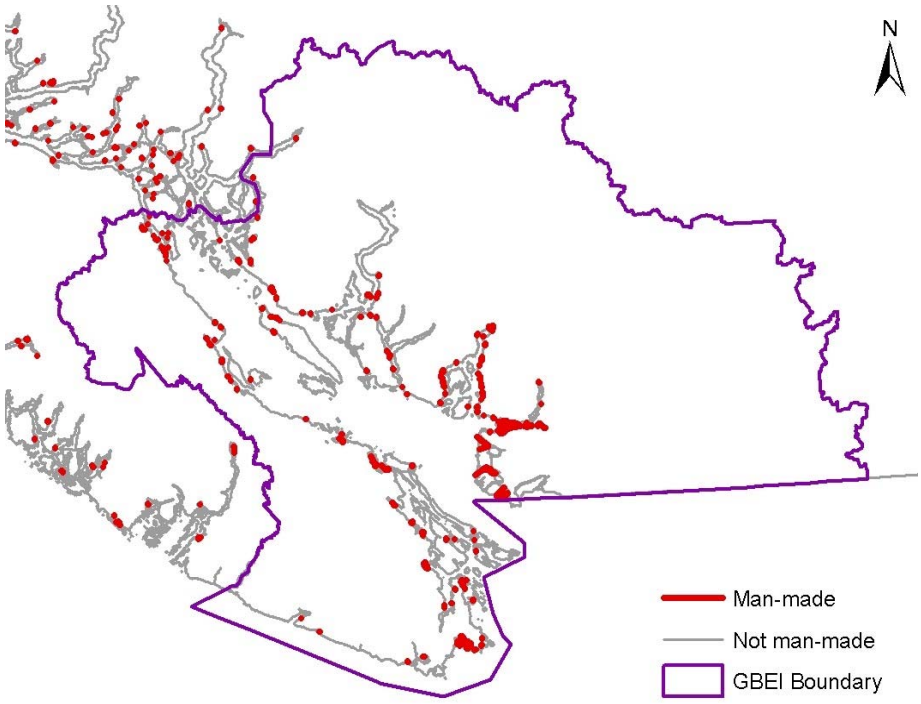
John Ryder discussed the status and trends in habitats in British Columbia. Ecologically significant lands and important wildlife habitats have been fast disappearing throughout the lowlands surrounding the Strait of Georgia. Threats to nearshore habitats are numerous, with the strongest being nearshore development: urban & industrial, port expansion, wind-farms, hydroelectric projects, aquaculture. Changing agricultural practices, water contaminants, invasive species and climate change also threaten nearshore habitats. In 1993 a joint federal/provincial *Sensitive Ecosystems Inventory* (SEI) *of East Vancouver Island and Gulf Islands* was undertaken; the inventory was repeated in 2004. The key habitat types include wetlands; riparian; older forest; woodland; terrestrial herbaceous; and sparsely vegetated coastal bluff. In 1993 7.9% of habitats on eastern Vancouver Island and the Gulf Islands were in a relatively natural state. By 2004 more than11% (over 8800 hectares**)** of those sensitive areas had been lost. The greatest losses were in old second growth forests (16%); old-growth forests (8%) and riparian areas (5%).

Among wetlands of the lower mainland of British Columbia, 5.5% of the area was lost between 1989 and 1999, largely to agricultural uses and golf course development (Figure 5) .



Looking at the estuarine shorelines in Georgia Basin, over 63% are under some kind of commercial use. However, the GB actually has more area tied up in conservation tenure than in economic interests, owing to some large land holdings by Ducks Unlimited Canada, Nature Conservancy of Canada, and Nature Trust of B.C. Much of the Georgia Basin estuaries are still undeveloped. The most significant changes to intertidal uses that are likely to be made in the next 10 years will take place in the estimated 60% of habitat that is currently vacant, designated as provincial crown lands.

Other significant management actions to understand and preserve nearshore habitat include advances in the Shorezone mapping system (which is also used in Washington State) which can help to distinguish the length of altered shoreline (5.3% in Georgia Basin, as shown in Figure 6).



Other key management indicators include the positive response from municipalities on the use of the *Sensitive Ecosystems Inventory*; and the Community Mapping Network which creates habitat maps incorporating citizen-collected information. In 2003 the Gulf Islands National Park was created at the south end of Georgia Basin, bringing a major new conservation area to the region. By 2004 there had been 51 rockfish conservation areas created in Georgia Basin.

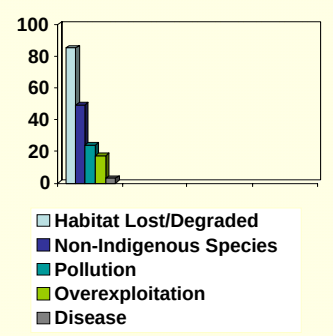
The good news on habitat conservation in Georgia Basin is the development of significant tools and the setting-aside of conservation and managed areas in the region. There are however still significant gaps to creating a comprehensive habitat protection

program including the need for more data to complete habitat classification systems; and the necessity of creating and maintaining continuous monitoring programs, using standardized procedures. There are also gaps in regulation and enforcement to achieve optimum conservation.

Aquatic Nuisance Species – David Secord

David Secord reviewed the state of knowledge about Aquatic Nuisance Species (ANS) since the MSP report, by examining what we have learned, how we have responded and what we may have missed.

Secord pointed out that while the MSP may have raised the issue of ANS in the region for the first time, there has been an increasing awareness worldwide that ANS can have serious and wide-spread consequences for marine ecosystem integrity, second only to loss and degradation of habitats (Figure 7 Wilcove et al. 1998.). Secord paid homage to Jim Carlton who has been warning about serious impact of invasives for many years.



A number of invasive organisms have been arriving and dispersing along the coasts and in the estuaries of the region including: European Green Crab (*Carcinus maenas*), spreading from California to Washington to British Columbia; Purple Varnish Clams (*Nuttallia obscurata*) , spreading from British Columbia to Washington to Oregon; several new tunicates established in Puget Sound; spread of four species of *Spartina* along the west coast; escapes from aquaculture operations including Atlantic salmon, Pacific oysters, Mediterranean mussels; algae such as *Caulerpa* and *Undaria*, and Chinese mitten crabs spreading along the west coast.

Secord discussed the research and management trends we have seen in the past decade including investigations of patterns of invasions such as Rapid Assessment Surveys in San Francisco Bay, in Puget Sound and on the coast of Washington; investigations into the process by which invasions occur with studies of population dynamics & genetics of specific invasions; technologies to reduce the risk of invasions from ballast water; and control technologies that include Integrated Pest Management and biocontrol.

The Rapid Assessment surveys carried out in Washington to date include:
1998: Puget Sound Fouling Communities; 2000: Willapa Bay & South Puget Sound Soft Sediments; 2001: Outer Coast Rocky Shores/Olympic Coast National Marine Sanctuary; 2002: Coastal Islands; and one planned for 2005 in the transboundary area. Typical results from one of these surveys include those from the 1998 Puget Sound survey: 39 ANS were found in 6 days of systematic sampling; 11 had not previously been recorded in Puget Sound; we now have 52 known non-native saltwater or brackish species in Puget Sound, showing no significant patterns with salinity, temperature, or geographic region of Puget Sound.

Other key observations include finding fewer invasives on the wind-and-wave-swept open coast than in the protected inshore waters. The presence of invasive species may make it easier for successive waves of new invasive species to become established. It also appears that some invasives may be more abundant in Marine Protected Areas than outside them. We need to remember that the absence of evidence (of impacts) is not evidence of absence of impacts, and there are often lag times before impacts are felt.

Education efforts about ANS have become increasingly common. Also a series of policy questions are being asked: Should we allow harvests of ANS such as varnish clams and mitten crab, as a means of control, as these measures can sometimes backfire and spread species further? Can we use citizens to help identify the early stages of invasions? Do we have the regulations and enforcement will to prevent ANS becoming established, including treatment of ballast water? How do we prevent economically important aquaculture species from posing invasion threats? What are the risks of using chemical or biological control of invasives in the environment?

There are signs of hope for dealing with ANS in the region: dramatically more awareness of ANS; increased collaboration between the natural and social scientists that will allow us to look at human behavior as vectors of invasion; we know a lot about the cross-boundary movement of larvae and we can use it to arm ourselves.

What Has Happened Since the MSP Report? – Andrea Copping

The state and the province had formed an International Task Force to address issues in Georgia Basin and Puget Sound, before the MSP came into being. Initially the Task Force had a water quality focus. After the MSP report, the Task Force was expanded to include agencies whose mandates more closely addressed the MSP recommendations, including fish and wildlife agencies and those concerned with Marine Protected Areas and invasive species. The Task Force created work groups to address many of the MSP recommendations; a number of reports were created including: *Pathways to Our Optimal Future: A five Year Review* (2000); *Georgia Basin-Puget Sound Ecosystem Indicators Report* (2002); and *Georgia Basin Action Plan 2003-2008* (2003).

The recommendations made by the MSP were reviewed and adjusted by the Task Force, as shown in Figures 8 and 9 (BC/WA Marine Science Panel 1994).

Task Force
Action recommendations

priority	Actions
highest	Minimize estuarine wetland habitat loss
	Establish marine protected areas
	Protect marine animals and plants
	Minimize large fresh water diversions
	Minimize introduction of exotic species
	Control toxic wastes
	Prevent large oil spills

International Task Forces Priorities

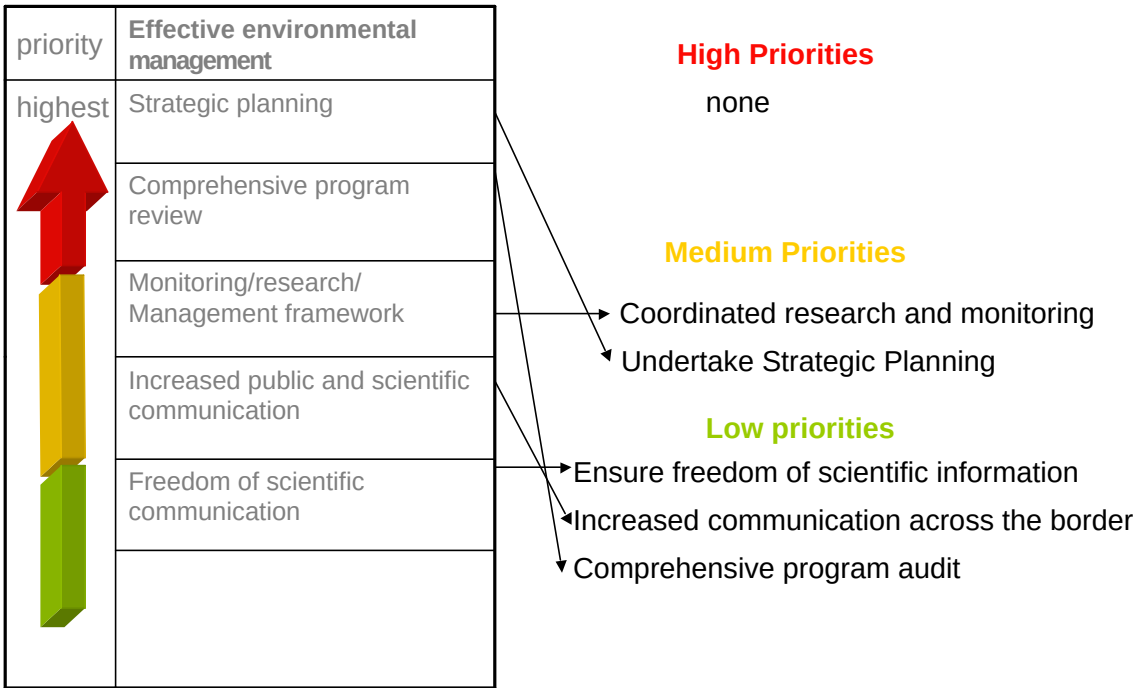
High Priority

- Protect marine animals and plants
- Establish marine protected areas
- Prevent nearshore habitat loss
- Prevent Introduction of Non-indigenous Species

Medium Priority

- Control toxic wastes
- Prevent large oil spills
- Minimize large fresh water diversions

Task Force
Management recommendations



The Task Force designated certain high priorities and developed actions under each:

HIGH PRIORTY ACTIONS DEFINED BY INTERNATIONAL TASK FORCE

Priority Action	Activity or Report
Protection of Marine Life	Multiple conservative fish management plans developed
	Report: *Protecting Plants and Animals in the Strait of Georgia: Ideas for Action*
Establish MPAs	Development of a Marine Protected Areas Strategy for Washington State, 1998
	WA: Final strategy put forward in 2000
	BC: National Marine Conservation Area feasibility study 1998-present
Prevention of Nearshore	Recommendations for improved management 1998
	Draft concept paper: Nearshore Habitat Protection and Residential Shoreline

Other actions were defined as medium and low priority:

MEDIUM PRIORITY ACTIONS DEFINED BY INTERNATIONAL TASK FORCE

Priority Action	Activity or Report
Control of Toxic Waste Discharge	Status, Trends and Effects of Toxic Contaminants in the Puget Sound Environment: Recommendations 2003

Coordinated research and monitoring	Limited progress due to other "more pressing priorities"
Undertake Strategic Planning	Georgia Basin Ecosystem Initiative (Georgia Basin Action Plan)
	Statement of cooperation on the Puget Sound and Georgia Basin Ecosystem
Prevent Large Oil Spills	Rescue tug capacity increased (current)
	Pacific States Oil Spill Task Force 1999
Prevention of Major Freshwater Diversions	Freshwater Strategy, 1999 - Provides many water conservation measures and stewardship activities (BC)

LOW PRIORITY ACTIONS DEFINED BY INTERNATIONAL TASK FORCE

Priority Action	Activity or Report
Ensure Freedom of Scientific Information	The task force "agrees and conducts itself in accordance with these recommendations"
Increased Communication Across the Boarder	Continue activities and participate in meetings with stakeholders, publicize significant transboundary issues, and collect information on groups involved
Comprehensive Program Audit	"could not be undertaken in the appropriate manner by the ITF"

Since 1994 and the MSP report we have learned several things: transboundary issues and the interest people feel in them have not diminished over 10 years. There is also continued interest in cooperating across the border, from governments, from non-governmental groups and from the public. There are many effort that support the spirit of the MSP recommendations including the Canada Oceans Act; Orca Pass Marine Stewardship proposal; the Northwest Straits Marine Conservation Initiative; and a number of fish conservation plans.

We have also learned that the issue of freedom of scientific speech is just as relevant today as it was ten years ago. We still see significant gaps in the use of science guiding environmental management decisions.

The MSP is aware that it is relatively easy to make pronouncements and create large-scale recommendations, as we did in 1994, but often it is very difficult to implement them. We encourage the government agencies to continue to work towards the goals supported by the MSP. We also suggest that taking a wide–angle look at the issues on a periodic basis, as we did in the early 1990s, could be useful.

References

British Columbia/WA Marine Science Panel. 1994. The Shared Waters of British Columbia and Washington: A Scientific Assessment of Current Status and Future Trends in Resource Abundance and Environmental Quality in the Strait of Juan de Fuca, Strait of Georgia, and Puget Sound. 119 pp. University of Washington, Seattle Washington.

Broadhurst, G. Puget Sound Nearshore Habitat Regulatory Perspective: A Review of Issues and Obstacles. Puget Sound Action Team. Olympia Washington www.psat.wa.gov/shared/taskforce7.html.

Environment Canada. 2002. *Georgia Basin-Puget Sound Ecosystem Indicators Report* wlapwww.gov.bc.ca/cppl/gbpsei/index.html

Environment Canada. 2003. *Georgia Basin Action Plan 2003-2008.*

Levings, C.D. and R.M. Thom. 1994. Habitat Changes in Georgia Basin: Implications for Resource Management and Restoration. Pp. 330-351. In: Review of the Marine Environment and Biota of the Strait of Georgia, Puget Sound and Juan de Fuca Strait. Proceedings of the BC/Washington Symposium on the Marine Environment. January 13 and 14, 1994. (eds,)R.C.H. Wilson, R.J. Beamish, F. Aitkens, and J. Bell. *Can Tech. Rep. Fish and Aquatic Sci.* No. 1948.

Lynn, B. 1998. Nearshore Habitat Loss in Puget Sound: Recommendations for Improved Management. Nearshore Habitat Loss Work Group in Washington.

Puget Sound Action Tam. 2000. *Pathways to Our Optimal Future: A five Year Review.* www.wa.gov/puget_sound/shared/shared.html

Wilcove, D.S., D. Rothstein, J. Dubow, A. Phillips and E. Losos. 1998. Quantifying Threats to Imperiled Species in the United States *Bioscience.*